

Advanced Quantum Mechanics of Many-Body Systems

summer term 2025-26

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Rules

- Lectures are on Thursdays at 12:15-14:00 in A1.02 room.
- Tutorials are on Mondays at 13:15-15:00 in A1.02 room.
- Home problems will be offered but not be checked. Some of these problems or similar ones might occur during an exam.
- Standard way of passing the course
 - Final written exam, max 100 pts.
 - Oral exam (in uncertain cases)
- Second (resit) exam to pass the course
 - Written exam, max 100 pts.
 - Oral exam (in uncertain cases)

Final grade is based on total score points normalized to 100 and determined as follows:

- 5+ for 99-100 pt.
- 5 for 90-98 pt.
- 4+ for 81-89 pt.
- 4 for 72-80 pt.
- 3+ for 62-71 pt.
- 3 for 50-61 pt.
- 2 for 0-49 pt.

Warning: points from the mod term exam and final exam and from the second exams do not sum up.

Dates of exams:

written exam I, January 28, 2026, 9:00-14:00, room B0.14

oral exam I, on e-mail note

written exam II, February 17, 2026, 9:00-14:00, room A1.03

oral exam II, on e-mail note

1 Preliminary Program

1. Many-body wave function of identical particles
2. One-particle approximation, Hartree-Fock theory
3. Density functional theory
4. Second quantization
5. Mean-field approximations and canonical transformations
6. Linear response theory and Kubo formulae

2 Link to tutorial materials

Here <https://www.fuw.edu.pl/~kjablonowski/> you will find tutorial materials for the lectures.

3 Literature

- EKU Gross, E Runge, O Heinonen, *Many-particle Theory*.
- G Gross, G Pastori Parravicini, *Solid State physics*.
- H Bruus, K Flensberg, *Many-Body Quantum Theory in Condensed Matter Physics*.
- M Fabrizio, *A Course in Quantum Many-Body Theory*.
- W Nolting, *Fundamentals of Many-Body physics*.
- R. A. Jishi *Feynman diagrams techniques in condensed matter physics*.
- G. Czycholl, *Solid state theory*, vol. 2.